PATENT #15

Docket No.: 4481-028

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of :
Bernhard DEHMER :
Serial No. 09/672,038 : Group Art Unit: 3753
Filed: September 29, 2000 : Examiner: J. Fox
For: VALVE FOR LIQUID SEPARATION

TRANSMITTAL OF APPEAL BRIEF

Honorable Commissioner of
Patents and Trademarks
Washington, DC 20231

Sir:

Submitted herewith in triplicate is Appellant's Appeal Brief in support of the Notice of Appeal filed May 28, 2002. A credit card authorization form is enclosed to cover the Appeal Brief fee of $320.00.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP

Allan M. Lowe
Registration No. 19,641

1700 Diagonal Road, Suite 310
Alexandria, Virginia 22314
(703) 684-1111/FAX: (703)518-5499
AML:cjf
Date: July 29, 2002

Docket No.: 4481-028 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of :
:
Bernhard DEHMER :
:
Serial No. 09/672,038 : Group Art Unit: 3753
:
Filed: September 29, 2000 : Examiner: J. Fox
:
For: VALVE FOR LIQUID SEPARATION

APPEAL BRIEF

Honorable Commissioner of
Patents and Trademarks
Washington, D. C. 20231

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed May 28, 2002.

I. REAL PARTY IN INTEREST

The real party in interest is Agilent Technologies, Inc., Palo Alto, California, a New York Stock Exchange Company which is a spin off of Hewlett-Packard Company. Agilent is a world wide leader in development, manufacture and sales of material analysis equipment; it's website is www.agilent.com.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals and/or interferences.

III. STATUS OF CLAIMS

Claims 2, 3, 5-11 and 14-18 are pending. Claims 1, 4 and 6-13 are cancelled. No claims are allowed. All pending claims are rejected under 35 USC 112, paragraph 2.

IV. STATUS OF AMENDMENTS

Appellant filed an Amendment April 28, 2002. The May 14, 2002, Advisory Action does not indicate whether or not the Amendment After Final Rejection was entered. Appellant will proceed on the basis the Amendment was entered because the Advisory Action does not indicate the Amendment After Final Rejection was not entered and gives no reasons why the Amendment After Final Rejection should not have been entered.

V. BRIEF DESCRIPTION OF THE INVENTION

The invention is summarized by reference to the substitute specification Appellant filed December 13, 2001, as required by the September 13, 2001, Office Action.

The invention concerns a valve for liquid separation, especially for analytical or preparative liquid chromatography (page 1, last paragraph). The valve has a body 21 having an inlet 22 and at least two outlets 23, 24 (page 8, lines 17 and 18). A sealing element 45 that can be spherical or conical (page 1, last paragraph) coupled with the inlet 22 and outlets 23, 24 has shut-

off surfaces 48, 49 (page 9, lines 10-14; page 14, lines 12-19) for alternately shutting off outlets 23, 24. Each of the shut-off surfaces 48, 49 includes an arcuate segment (page 14, lines 19-22). The shut-off surfaces 48, 49 are respectively tapered toward ports 32 and 33 (page 9, lines 11-14). The shut-off surfaces 48, 49 respectively associated with the outlets 23, 24 are arranged to face away from each other (page 9, lines 11-14).

Sealing element 45 is at a free end of actuator 50 (page 9, line 16). Shut-off surfaces 80, 84 of valve body 21 oppose shut off surface 48 of sealing element 45 (page 14, lines 12-14). Shut-off surfaces 80, 84 narrow conically (page 11, lines 19-24) or as a funnel toward the outlet 23 that opposes the free end of the actuator 50. An outlet area is located between shut off surfaces 80, 84 and outlet channel 27 (page 10, line 7). The outlet channel has a conically narrowing opening surface 34 (page 13, line 22).

The outlets 23, 24 and sealing element 45 are arranged so that when a first of outlets 23 is shut off, the sealing element 45 assigned to seal the first outlet 23 rests on opposing shut-off surfaces 80, 84 of valve seat 36 to form an annular sealing surface (page 16, lines 1-22). The opposing shut-off surfaces 80, 84 have a step or nose-shaped projection 86 at the annular sealing surface (page 16, line 20).

In the position of sealing element 45 illustrated in Figure 2, tapered shut-off surface 49 of the sealing element bears against

the opposing tapered shut-off surface 94 of annular valve seat 37 to prevent the flow of liquid from inlet 22 to outlet 24 (page 15, lines 10-13). In this position, a narrow annular gap or passage 70 is formed between shut-off surface 48 of sealing element 45 and the opposing shut-off surfaces 80 and 84 of annular valve seat 36 (page 15, lines 13-16). Liquid thereby flows through gap or passage 70 from inlet 22 to outlet 23 (page 15, lines 16-20).

In response to sealing element 45 being shifted to the left in the direction of arrow 29, as illustrated in Figure 2, along longitudinal axis 51, a gap is provided between opposing tapered shut off surfaces 49 and 94 so that liquid can flow from inlet 22 to outlet 24 via annular channel 55 (page 16, line 23-page 17, line 3). As sealing element 45 is shifted in the direction of arrow 29, the sealing element contacts sealing lip 87 so that tapered shut-off surface 48 presses against the opposing shut-off surface 80 of annular valve seat 36 (page 16, lines 13-18). Projection 86, shaped as sealing lip 87 between surfaces 80 and 84, deforms slightly as a result of the projection being contacted by sealing element 45 (page 16, lines 19-22). Shut-off surface 48 thereby seals the step or nose-shaped projection 86 between surfaces 80 and 84 to prevent the flow of liquid from inlet 22 to outlet 23 (page 16, lines 6-8).

VI. ISSUES

A. The appealed claims are sufficiently definite to comply with 35 USC 112, paragraph 2.

VII. GROUPING OF CLAIMS

Separate arguments are submitted with regard to claims 15, 16, 17. Since the only rejection is on 35 USC 112, paragraph 2, claims 2, 3, 5 and 11, which depend on claim 15 rise and fall with claim 15, and claims 18-28, which depend on claim 17, rise and fall with claim 17. Since the same grounds of rejection are asserted against claim 29 as claim 17 and claims 30-38 depend on claim 29, claims 29-38 rise and fall with claim 17. Claims 39-48, which depend on claim 16, rise and fall with claim 16.

VIII. THE ARGUMENT

The only basis for rejection of pending claims 2, 3, 5-11 and 14-48 is because of alleged indefinite, inaccurate or unclear aspects of independent claims 15, 16, 17 and 29, upon which claims 2, 3, 5-11, 14, 18-28 and 30-48 depend.

The Examiner says claim 15, line 8 is unclear because "it is unclear what is at the free end" of an actuator. Claim 15 makes it clear that the shut-off surfaces of the sealing element are at the free end of the actuator by reciting "the shut-off surfaces respectively associated with the outlets being arranged to face

away from each other, and being at a free end of an actuator." Because there are no other shut-off surfaces recited up to this point in claim 15, the reference to "the shut-off surfaces" in the foregoing quotation must be to the shut-off surfaces of the sealing element.

The allegation that there need be a specific antecedent basis for "opposing shut-off surfaces of the valve body" is wrong. *The Manual of Patent Examining Procedure*, Section 2173.05(e), states:

> Obviously, however, the failure to provide explicit antecedent basis for terms does not always render a claim indefinite. If the scope of a claim would be reasonably ascertainable by those skilled in the art, then the claim is not indefinite. *Ex parte Porter*, 25 USPQ 2d 1144, 1145 (Board of Patent Appeals and Interferences, 1992). ('Controlled stream of fluid' provided reasonable antecedent basis for 'the controlled fluid.') Inherent components of elements recited have antecedent basis in the recitation of the components themselves. For example, the limitation 'the outer surface of said sphere' would not require an antecedent recitation that the sphere has an outer surface.

A valve body co-operating with a sealing element of a valve inherently includes shut-off surfaces that oppose shut-off surfaces of a sealing element. Hence, there is no need for claim 15 to specifically define the shut-off surfaces of the valve body, as pointed out in MPEP Section 2173.05(e).

The allegation that there must be a specific antecedent basis for "the outlet that opposes the free end of the actuator" is also wrong. All valves have outlets for the fluid that flows through them. Consequently, the valve of claim 15 inherently includes an outlet and it is not necessary to recite an outlet specifically.

The remainder of the quoted clause merely adds the limitation that the valve outlet opposes the free end of the actuator. Since all valves have an outlet, there is no need to recite "an outlet." Certainly, a manufacturer or prospective manufacturer, seller or user of valves, would know that its valve or proposed valve has an outlet. MPEP Section 2173 indicates this is the primary purpose of 35 USC 112, paragraph 2.

The Examiner incorrectly alleges that the requirement of claim 15 for the "opposing shut-off surfaces of the valve body narrowing conically or as a funnel toward the outlet that opposes the free end of the actuator" requires "both valve seats to narrow toward the one outlet." This position of the Examiner ignores MPEP Section 2173.02, which says:

> Definiteness of claim language must be analyzed, not in a vacuum, but in light of:
>
> (A) The content of the particular application disclosure;
>
> (B) The teachings of the prior art; and
>
> (C) The claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.

The requirement of claim 15 for "the opposing shut-off surfaces of the valve body narrowing conically or as a funnel toward the outlet that opposes the free end of the actuator" clearly refers to frusto-conical surfaces 80 and/or 84 of Figure 2 that narrow conically or as a funnel toward outlet 23. The Examiner has read

this language in a vacuum, not in light of the content of Appellant's disclosure, the prior art, and how one of ordinary skill in the art would have interpreted it.

The Examiner's comment in the Advisory Action about the language of lines 8-12 of claim 16 being applicable to claim 15 is wrong because the language in lines 8-12 of claim 16 does not appear in claim 15.

The Examiner is wrong in saying the recitation in claim 16, lines 9 and 10, for "the sealing element assigned to seal the first outlet" lacks clarity. The Examiner says this language "suggests there is more than one sealing element." In fact, the specification says there can be several sealing elements 45 affixed to a single tappet valve. Such several sealing elements are offset axially. There can be several additional corresponding inlet and outlet channels; see page 18, lines 9-13. The language of claim 16, lines 9 and 10, which the Examiner says is unclear merely means the valve can possibly have more than one sealing element and that the sealing element assigned (i.e., associated with) to seal the "first of the outlets" has certain attributes. The Examiner's reason for this alleged lack of clarity is simply wrong. The claim language meets the previously mentioned requirements of MPEP Section 2173.02. The Examiner has given no reason why the language is indefinite.

The Examiner appears to allege that the requirement of claim 16, lines 8-12 for "the outlets and sealing element are arranged so that when a first of the outlets is shut off, the sealing element assigned to seal the first outlet rests on opposing shut-off surfaces of a valve seat of the valve body to form an annular sealing surface" is inaccurate and indefinite. He says this language is inaccurate because "it calls for the sealing element to rest on both seats in one position." The Examiner is reading these words in a vacuum. He has paid no attention to the fact that valve seat 36 has shut-off surfaces 80 and 84 that oppose shut-off surface or surfaces 48 of sealing element 45. Consequently, lines 8-12 of claim 16 are accurate and definite.

The foregoing discussion about claim 16, lines 8-12, demonstrates the incorrectness of the comment in the Advisory Action that the "language of lines 8-12 of claim 16 makes little sense and it is hard to see how it can be argued that the metes and bounds of the invention are set forth as required by §112."

In the Advisory Action, the Examiner withdrew the rejection of claim 17, lines 3 and 4, and claim 17, lines 10-13.

The Examiner erroneously rejects claim 17 for lack of antecedent basis for "the passage interior surface" in line 9 of the claim. All passages have an interior surface. Hence the only passage that claim 17 recites, in line 4, inherently includes the interior surface recited in line 9. Since inherent properties need

not be specifically recited, this basis for rejection is wrong. The Examiner's comment in the Advisory Action that passages are known which are annular is irrelevant because an annular passage has an interior surface. The comment about passages in the atmosphere or a space is wrong because such passages have nothing to do with a valve. Both of these comments by the Examiner in the Advisory Action are taken in a vacuum and completely out of context with regard to a passage between inlet and outlet ports of a valve.

The Examiner's comment about "the tapered sealing surface" in claim 17, line 17, is incorrect. Claim 17 previously said in lines 13 and 14, "the sealing element including a tapered peripheral surface." There is no other prior recitation of a "tapered surface" in the claim. It is obvious to one of ordinary skill who reads claim 17 that the "tapered sealing surface" in line 17 is the same surface as the tapered peripheral surface of the sealing element that was previously defined in the claim. MPEP Section 2173.05(e) (ibid) makes it clear that the exact language previously employed in a claim need not be used later in the claim.

The Examiner's comment about "the sealing element surface" in claim 17, lines 19 and 20, is also wrong. The reference to "the sealing element surface" in claim 17, lines 19 and 20, is obviously to the tapered peripheral surface of the sealing element recited in lines 13 and 14 and to the same structure which is recited in line 17 as "the tapered sealing surface." As previously indicated, the

same structure can be defined in a claim with slightly different words if the words are unambiguous as is the case here, particularly when the claim is read in context with the specification.

The comment in the Advisory Action about claim 22 is irrelevant. The comment seems to be that claim 17 is indefinite because claim 22 depends on claim 17, and claim 22 says "the sealing element peripheral surface." Lines 13 and 14 of claim 17 say "the sealing element including a tapered peripheral surface." It is obvious that the "sealing element tapered peripheral surface" of claim 22 is the same as the tapered peripheral surface included in the sealing element.

By the way, the tapered nature of sealing surfaces 48 and 49 is described on page 9, lines 11-14. The Examiner needs to consider this fact in connection with his objection to the drawing which says the drawing is objectionable because the drawing does include the claimed taper.

No discussion of claim 29 is necessary because the Examiner does not specifically discuss any issues with regard to claim 29 in either the final rejection or the Advisory Action. The Advisory Action says the same "remarks apply to claim 29 as well."

CONCLUSION

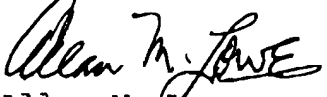
Appellant has demonstrated that each of the alleged indefinite aspects of claims 15, 16, 17 and 29 is incorrect.

Reversal is in order.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 07-1337 and please credit any excess fees to such deposit account.

Respectfully submitted,

LOWE HAUPTMAN GILMAN & BERNER, LLP



Allan M. Lowe
Registration No. 19,641

1700 Diagonal Road, Suite 310
Alexandria, Virginia 22314
(703) 684-1111/FAX: (703)518-5499
AML:cjf
Date: July 29, 2002

APPENDIX

2. The valve of claim 15 wherein the shut-off surfaces are radially symmetrical to an actuation axis of the actuator for translating the sealing element.

3. The valve of claim 2 wherein the actuator includes a tappet valve connected to the sealing element.

5. The valve of claim 3 wherein cross-sections of the shut-off surfaces in planes extending in the direction of longitudinal movement of the actuator and surface parts of the sealing element which mate with the shut-off surfaces and are opposite the inlet form an essentially continuous line.

6. The valve of claim 1 wherein the outlets and sealing element are arranged so that when one of the outlets is shut off, the sealing element with its shut-off surface associated with its respective outlet rests on opposing shut-off surfaces of a valve seat of the valve body to form an annular sealing surface.

7. The valve of claim 15 wherein the opposing shut-off surfaces form an angle with the actuation axis at the annular sealing surface that is greater than or equal to 15°.

8. The valve of claim 7 wherein the angle is at least 30E.

9. The valve of claim 15 wherein the opposing shut-off surfaces of the valve body are formed of material that is softer and more elastic than shut-off surfaces of the sealing element.

10. The valve of claim 9 wherein the valve seat material is TEFLON.

11. The valve of claim 15 wherein the opposing shut-off surfaces have a step or nose-shaped projection at the annular sealing surface.

14. The valve of claim 15 wherein the outlets are on both sides of the inlet and oppose each other.

15. A valve for liquid separation, especially for analytical or preparative liquid chromatography, comprising a valve body having an inlet and at least two outlets, a sealing element coupled with the inlet and outlets, the sealing element including shut-off surfaces for alternately shutting off the outlets, the shut-off surfaces including an arcuate segment, the shut-off surfaces respectively associated with the outlets being arranged to face away from each other, and being at a free end of an actuator, the opposing shut-off surfaces of the valve body narrowing conically or as a funnel toward the outlet that opposes the free end of the actuator, an outlet area being arranged between the opposing shut-off surfaces and an outlet channel, the outlet channel having a conically narrowing opening surface.

16. A valve for liquid separation, especially for analytical or preparative liquid chromatography, comprising a valve body having an inlet and at least two outlets, a sealing element coupled with the inlet and outlets, the sealing element including shut-off

surfaces for alternately shutting off the outlets, the shut-off surfaces including an arcuate segment, the shut-off surfaces respectively associated with the outlets being arranged to face away from each other, wherein the outlets and sealing element are arranged so that when a first of the outlets is shut off, the sealing element assigned to seal the first outlet rests on opposing shut-off surfaces of a valve seat of the valve body to form an annular sealing surface, the opposing shut-off surfaces having a step or nose-shaped projection at the annular sealing surfaces.

17. A valve for selectively supplying fluid from an inlet port to an outlet port comprising a sealing element, a passage selectively opened and shut between the inlet and outlet ports by the sealing element, the passage and the sealing element being arranged so there is relative longitudinal back and forth movement between them in first and second opposite directions along a longitudinal axis such that when the sealing element is at (a) a first position relative to the passage along the axis, the sealing element is disengaged from the passage interior surface to provide a fluid flow path between the inlet and outlet ports, and (b) a second position relative to the passage along the axis, the sealing element engages a portion of the passage interior surface to form a seal between the inlet and outlet ports, the sealing element including a tapered peripheral surface extending generally in the direction of the axis, portions of the peripheral surface being

sized and arranged for selectively engaging portions of the passage interior surface to form the seal, the tapered sealing surface having cross sections of progressively larger perimeters along the axis such that the cross-section of the sealing element sealing surface closest to the outlet port has the smallest perimeter that is closer to the longitudinal axis than any other cross-section of the sealing element sealing surface, the passage interior surface including a tapered surface having cross sections of progressively larger perimeters along the axis such that the cross-section of the passage interior surface closest to the outlet port has the smallest perimeter that is closer to the longitudinal axis than any other cross-section of the passage interior surface, the passage interior surface including first and second segments that are displaced from each other along the axis so that the first segment is closer to the outlet port than the second segment and the second segment is closer to the inlet port than the first segment, the perimeters of all cross sections of the second segment being greater than the perimeters of all cross sections of the first segment so all of the passage interior surfaces of the first segment are closer to the axis than all the passage interior surfaces of the second segment, the passage interior surface including a lip between adjacent portions of the first and second segments, the length of the lip in a direction at right angles to the axis being substantially less than (a) the distance between the

axis and the perimeter of the cross-section of the first segment farthest from the outlet port and (b) the distance between the axis and the perimeter of the cross-section of the second segment closest to the outlet port, the tapered peripheral surface and the passage interior surface being sized, positioned and arranged so that (a) during initial movement of the sealing element from the first position toward the second position a flow path is provided between the inlet and outlet ports between the tapered peripheral surface of the sealing element and the passage interior surface including the first and second second segments, and (b) as the sealing element continues to move toward the outlet port the tapered sealing surface of the sealing element engages the lip to form a seal and prevent fluid flow between the inlet and outlet ports, the spacings between the tapered sealing surface and the passage interior surfaces of the first and second segments while the flow path is provided during the initial movement of the sealing element being substantially less than (a) the distance between the axis and the perimeter of the cross-section of the first segment farthest from the outlet port, and (b) the distance between the axis and the perimeter of the cross-section of the second segment closest to the outlet port.

18. The valve of claim 17 wherein the sealing element peripheral surface is arcuate and the passage interior surfaces of the first and second segments are frusto-conical.

19. The valve of claim 18 wherein the sealing element peripheral surface is a segment of a sphere and cross sections of the passage interior surfaces in planes at right angles to the axis are circular.

20. The valve of claim 19 wherein the lip is arranged to deform slightly in response to the sealing element continuing to move from the initial sealed state between the lip and the peripheral surface along the axis toward the outlet port to provide an annular sealing surface having a length in the direction of the axis that increases from the length of the annular sealing surface when initial contact occurs between the sealing element peripheral surface and the lip.

21. The valve of claim 17 wherein the lip is arranged to deform slightly in response to the sealing element continuing to move from the initial sealed state between the lip and the peripheral surface along the axis toward the outlet port to provide an annular sealing surface having a length in the direction of the axis that increases from the length of the annular sealing surface when initial contact occurs between the sealing element peripheral surface and the lip.

22. The valve of claim 17, wherein the valve is arranged for selectively supplying fluid from the inlet port to a second outlet port via a second passage between the inlet port and second outlet port, the sealing element peripheral surface and the interior

surface of the second passage being arranged so that a fluid flow path is provided between the inlet port and the second outlet port while the sealing element is at the first position and a seal is provided between the inlet port and the second outlet port while the sealing element is at the second position; the sealing element, the interior surface of the second passage and the interior surface of the second segment being arranged to provide a flow path between the inlet port and a surface of the sealing element for supplying fluid from the inlet port to the surface of the sealing element to provide a fluid pressure for urging the sealing element against the lip while the sealing element is at the second position.

23. The valve of claim 22 wherein the second passage is coaxial with the axis and the inlet port is between the second segment and the second outlet port, and further including an actuator for translating the sealing element between the first and second positions, the actuator including a shaft extending in the second passage along the axis, one end of the shaft being connected to the sealing element.

24. The valve of claim 23 wherein the actuator shaft has circular cross sections at right angles to the axis so that the second passage has annular cross sections.

25. The valve of claim 22 wherein the second passage includes a section with a continuous taper between the inlet port and the second outlet port, the taper of the second passage being such that

the perimeter of the cross-section of the tapered section closest to the inlet port is greater than the perimeter of all other cross-sections of the tapered section and the perimeter of the cross-section of the tapered section closest to the second outlet port is smaller than the perimeter of all other cross-sections of the tapered section, and the portion of the sealing element peripheral surface for forming a seal between the sealing element and the second outlet port is tapered such that when the sealing element seals the second outlet port cross sections of the sealing element peripheral surface closest to the inlet port have greater perimeters than cross sections of the sealing element peripheral surface closest to the second outlet port.

26. The valve of claim 25 wherein the continuous taper of the second passage has a frusto-conical shape and the portion of the sealing element sealing surface for forming the seal between the sealing element and the second outlet port has an arcuate shape.

27. The valve of claim 26 wherein the continuous taper of the second passage has circular cross sections at right angles to the axis and the portion of the sealing element peripheral surface for forming a seal between the sealing element and the second outlet port is a sector of a sphere.

28. The valve of claim 22 wherein the sealing element and the passages are arranged so that as the sealing element translates

between the first and second positions fluid flow paths are provided between the inlet port and both outlet ports.

29. A valve for selectively supplying fluid from an inlet port to an outlet port comprising a sealing element, a passage selectively opened and shut between the inlet and outlet ports by the sealing element, the passage and the sealing element being arranged so there is relative longitudinal back and forth movement between them in first and second opposite directions along a longitudinal axis such that when the sealing element is at (a) a first position relative to the passage along the axis the sealing element is disengaged from the passage interior surface to provide a fluid flow path between the inlet and outlet ports, and (b) a second position relative to the passage along the axis the sealing element engages a portion of the passage interior surface to form a seal between the inlet and outlet ports, the sealing element including a tapered peripheral surface extending generally in the direction of the axis, portions of the peripheral surface being sized and arranged for selectively engaging portions of the passage interior surface to form the seal, the tapered peripheral surface having cross sections of progressively larger perimeters along the axis such that the cross-section of the sealing element sealing surface closest to the outlet port has the smallest perimeter that is closer to the longitudinal axis than any other cross-section of the sealing element sealing surface, the passage interior surface

including a tapered surface having cross sections of progressively larger perimeters along the axis such that the cross-section of the passage interior surface closest to the outlet port has the smallest perimeter that is closer to the longitudinal axis than any other cross-section of the passage interior surface, the passage interior surface including a lip, the tapered peripheral surface and the passage interior surface being sized, positioned and arranged so that (a) during initial movement of the sealing element from the first position toward the second position a flow path is provided between the inlet and outlet ports between the tapered peripheral surface of the sealing element and the passage interior surface, the lip being arranged to deform slightly in response to the sealing element continuing to move toward the outlet port from the initial sealed state between the lip and the peripheral surface along the axis to provide an annular sealing surface having a length in the direction of the axis that increases from the length of the annular sealing surface when initial contact occurs between the sealing element peripheral surface and the lip.

30. The valve of claim 29 wherein the sealing element peripheral surface is arcuate and the passage interior surfaces of the first and second segments are frusto-conical.

31. The valve of claim 30 wherein the sealing element peripheral surface is a segment of a sphere and cross sections of the passage interior surfaces in planes at right angles to the axis are circular.

32. The valve of claim 30, wherein the valve is arranged for selectively supplying fluid from the inlet port to a second outlet port via a second passage between the inlet port and second outlet port, the sealing element peripheral surface and the interior surface of the second passage being arranged so that a fluid flow path is provided between the inlet port and the second outlet port while the sealing element is at the first position and a seal is provided between the inlet port and the second outlet port while the sealing element is at the second position; the sealing element, the interior surface of the second passage and the interior surface of the second segment being arranged to provide a flow path between the inlet port and a surface of the sealing element for supplying fluid from the inlet port to the surface of the sealing element to provide a fluid pressure for urging the sealing element against the lip while the sealing element is at the first position.

33. The valve of claim 32 wherein the second passage is coaxial with the axis and the inlet port is between the second segment and the second outlet port, and further including an actuator for translating the sealing element between the first and

second positions, the actuator including a shaft extending in the second passage along the axis, one end of the shaft being connected to the sealing element.

34. The valve of claim 33 wherein the actuator shaft has circular cross sections at right angles to the axis so that the second passage has annular cross sections.

35. The valve of claim 32 wherein the second passage includes a section with a continuous taper between the inlet port and the second outlet port, the taper of the second passage being such that the perimeter of the cross-section of the tapered section closest to the inlet port is greater than the perimeter of all other cross-sections of the tapered section and the perimeter of the cross-section of the tapered section closest to the second outlet port is smaller than the perimeter of all other cross-sections of the tapered section, and the portion of the sealing element peripheral surface for forming a seal between the sealing element and the second outlet port is tapered such that when the sealing element seals the second outlet port cross sections of the sealing element peripheral surface closest to the inlet port have greater perimeters than cross sections of the sealing element peripheral surface closest to the second outlet port.

36. The valve of claim 35 wherein the continuous taper of the second passage has a frusto-conical shape and the portion of the

sealing element sealing surface for forming the seal between the sealing element and the second outlet port has an arcuate shape.

37. The valve of claim 36 wherein the continuous taper of the second passage has circular cross sections at right angles to the axis and the portion of the sealing element peripheral surface for forming a seal between the sealing element and the second outlet port is a sector of a sphere.

38. The valve of claim 32 wherein the sealing element and the passages are arranged so that as the sealing element translates between the first and second positions fluid flow paths are provided between the inlet port and both outlet ports.

39. The valve of claim 16 wherein the shut-off surfaces are radially symmetrical to an actuation axis of the actuator for translating the sealing element.

40. The valve of claim 39 wherein the actuator includes a tappet valve connected to the sealing element.

41. The valve of claim 40 wherein cross-sections of the shut-off surfaces in planes extending in the direction of longitudinal movement of the actuator and surface parts of the sealing element which mate with the shut-off surfaces and are opposite the inlet form an essentially continuous line.

42. The valve of claim 41 wherein the opposing shut-off surfaces form an angle with the actuation axis that is greater than or equal to 15°.

43. The valve of claim 16 wherein the opposing shut-off surfaces form an angle with the actuation axis at the annular sealing surface that is greater than or equal to 15°.

44. The valve of claim 43 wherein the opposing shut-off surfaces of the valve seat includes material that is softer and more elastic than the shut-off surfaces of the sealing elements.

45. The valve of claim 16 wherein the opposing shut-off surfaces of the valve body are formed of material that is softer and more elastic than shut-off surfaces of the sealing element.

46. The valve of claim 45 wherein the opposing shut-off surfaces have a step or nose-shaped projection at the annular sealing surface.

47. The valve of claim 16 wherein the opposing shut-off surfaces have a step or nose-shaped projection at the annular sealing surface.

48. The valve of claim 16 wherein the outlets are on both sides of the inlet and oppose each other.